

REMARKS

Applicants appreciate the consideration shown by the Office as evidenced by the Office Action mailed on 24 June 2004. In that Office Action, the Examiner rejected claims 1-22 and 24-28. The Examiner objected to claim 23. In this Response, Applicants have amended claims 1, 26, 27 and 28. Claims 1-28 remain pending in this application. Applicants respectfully request favorable reconsideration in light of the above amendments and the following remarks.

A. Election/Restriction

Claims 1-63 are pending in the current prosecution. Applicants hereby affirm the election of claims 1-28 (Group I) for prosecution on the merits.

B. Claim Objections

Claim 1 was objected to because the phrase "using at least one.... group consisting of" did not make sense. Claim 1 has been amended to more clearly recite the Markush group. Applicants found that during the course of filing the application via electronic filing, the complete text of claim 1 was not transmitted; hence Claim 1 has been amended to more clearly recite the elements of the Markush group. Applicants respectfully submit that Claim 1 now overcomes this objection.

C. Claim Rejections**1. Lin and McCulloch**

Claims 1-11, 3-16, 18, 19, 24 and 25 were rejected under 35 U.S.C. 103(a) as being unpatentable over Lin ("Lin"), U.S. 5,401,338 in view of McCulloch et al. ("McCullough "), U.S. 6,245,425 B1. Applicants respectfully traverse this rejection.

The applied combination of references fails to teach, suggest, or disclose all of the limitations of independent claim 1. In particular, the combination fails to teach, suggest, or disclose

"agitating said molten material using ultrasonic energy to disperse said nano-sized material within said molten material." Contrary to the Examiner's statements in the Office Action, Lin does not disclose the use of ultrasonic energy for agitating the molten material. Instead Lin describes that agitation of molten metal is by mechanical means, as shown in col. 4, lines 24 – 47, "The agitating means 18 includes an agitator shaft.....ultra fine reinforcing material of the present invention." As noted, the Lin reference teaches the use of ultrasonic waves as an oscillating means for only the suspension liquid and not the molten material: col. 5, lines 67-68 "The suspension liquid 5 is oscillated by ultrasonic waves for 30 minutes and is poured into the feeding container 7." The suspension liquid is formed by suspending a dispersion of the ultra fine reinforcing material in distilled water along with a dispersing agent. col. 2, lines 53-56. The suspension liquid is thus water based and is distributed, atomized or sprayed to the surface of the molten alloy. The agitation for the molten material is carried out, not by ultrasonic methods, but by means of a driving motor with impellers that rotate at a speed of about 440 rotations per minute. "The agitating rotation speed of the agitating means 18 is then reduced to 80 rpm after finishing the spraying operation of the suspension liquid into the molten alloy for continuing the rotation of 10 minutes." col.5 lines 57-59. Lin merely describes ultrasonic agitation of the water-based suspension that is introduced into a mechanically agitated quantity of molten material. Lin fails to fairly suggest that ultrasonic agitation can or should be applied to the molten material, as recited in claim 1 of the present application.

McCullough does not overcome the deficiencies of Lin. This reference discloses fiber reinforced aluminum matrix composite wire. The reference does disclose the use of ultrasonic energy to overcome the problem of incomplete matrix infiltration of the fiber tow (Col.7, lines30-33; "The problem of incomplete matrix infiltration of the fiber tow can be overcome through the use of a source of ultrasonic energy as a matrix infiltration aid."). McCullough also discloses the use of an "ultrasonic horn" as a method of wetting the fibers (Col. 8, Lines 39-41; "To obtain wetting of the fibers, an ultrasonic horn is used to agitate the bath while the fibers pass thru it.")

However, there is nothing in the McCullough reference that suggests "**dispersing** said nano-sized material within said molten material using at least one dispersion technique selected from the group consisting of

- a. agitating said molten material using ultrasonic energy to disperse said nano-sized material within said molten material;

- b. introducing at least one active element into said molten material to enhance wetting of said nano-sized material by said molten material; and
- c. coating said nano-sized material with a wetting agent to promote wetting of said molten metal on said nano-sized material

The ultrasonic energy is employed by McCullough merely to agitate the bath in order to more effectively infiltrate the fibers and does neither suggest nor disclose, and in no way even contemplate, the use of ultrasonic energy for dispersion of discontinuous reinforcing material into the molten matrix. As the materials contemplated in McCullough are continuous fiber reinforced composite wires, there is no dispersion of reinforcement matrix occurring—the fibers are simply towed through the agitated bath to infiltrate them with metal prior to removing the wire from the bath.

In summary, the combination of Lin and McCullough fails to teach, suggest, or disclose the use of ultrasonic energy as a technique to disperse material within a molten material. Lin describes the use of ultrasonic energy to disperse material within a water-based suspension prior to introducing the suspension into a mechanically agitated molten material. McCullough describes the ultrasonic agitation of a molten material as an aid to infiltration of fiber tows drawn through the molten material to make wires. Neither reference, alone or in combination, fairly suggests the use of ultrasonic energy recited in claim 1 of the present application. Applicants thus respectfully submit that claim 1 and its dependent claims 2-11, 13-16, 18, 19, 24, and 25, are patentably distinct from the applied combination of references. Favorable reconsideration is requested.

2. Angeliu et al.

Claims 1-22 and 24-28 were rejected under 35 U.S.C. 103(a) as being unpatentable over Angeliu et al. ("Angeliu"), U.S. 6,251,159 in view of either Lin or McCullogh. Applicants respectfully traverse this rejection.

This applied combination of references does not teach or suggest all of the limitations of claim 1-22 and 24-28. As discussed above, the Lin and McCullough combination fails to teach, suggest, or disclose the use of ultrasonic energy as a technique to disperse material within a molten

material. Angeliu does not overcome this deficiency, and therefore the listed claims are patentable under 35 U.S.C. § 103(a) over Angeliu in view of either Lin or McCullough.

Angeliu discloses forming metal matrix composites by dispersing nanophase particles in the metallic melt. As noted by the Examiner, the Angeliu does not include or suggest the use of ultrasonic energy for dispersion of the particles in the melt. Instead, Angeliu describes that the nanoparticles are added mechanically into the melt phase and the dispersing comprises mechanically mixing the nanophase particles in the melt. Col.4, lines 47-55. Here again, with respect to limitations on the method of dispersing the particles in the melt, Angeliu does not teach the Applicants' claimed invention.

As pointed out above, neither Lin nor McCullough discloses the use of ultrasonic energy to disperse the nano-sized material into the molten material. Therefore, adding Angeliu to show a possible dispersion of nanophase particles in a metallic melt still does not show all of the limitations of claims 1-22 and 24-28.

Since a combination of Lin, McCullough, and Angeliu does not teach or suggest all of the limitations of claim 1-22 and 24-28, these claims are patentable under 35 U.S.C. § 103(a) over Angeliu in view of either Lin or McCullough. Favorable reconsideration is requested.

C. Allowable Subject Matter

The Examiner objected to Claim 23 as being dependent upon a rejected base claim. The Applicants appreciatively note the Examiner's acknowledgement that Claim 23 recites allowable subject matter. Further the Applicants believe that, for the reasons described above, Claim 1 is allowable as it stands and therefore the Applicants submit that as the Claim 23 depends from an allowable claim, the Claim 23 should be allowable. Applicants respectfully request favorable reconsideration of this objection.

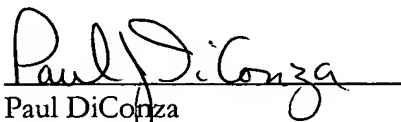
D. Conclusion

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In light of the remarks presented herein, Applicants believe that this serves as a complete response to the subject Office Action. If, however, any issues remain unresolved, the Examiner is invited to telephone the undersigned at the number provided below.

Respectfully submitted,

A handwritten signature in black ink, reading "Paul DiConza", written over a horizontal line.

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